SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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No. 2575.—VOL. LIV. LONDON, SATURDAY, DECEMBER 27, 1884. PRICE (WITH THE JOURNAL) SIXPENCE BY POST £1 4s. PER ANNUM,

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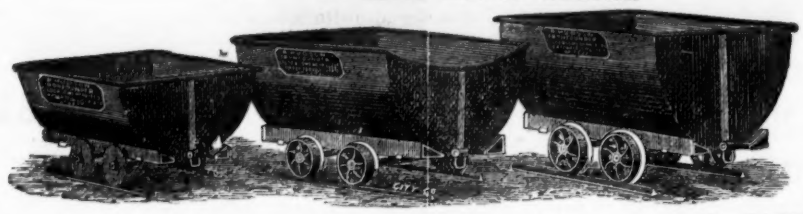
CAN BE MADE TO ANY SIZE, AND TO ANY GAUGE OF RAILS.

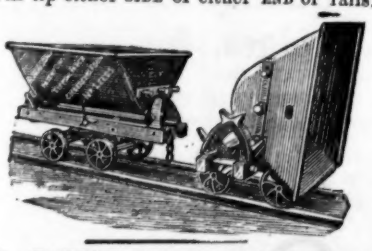
1.—PATENT STEEL END TIP WAGONS.

7.—PATENT STEEL MINING WAGONS.

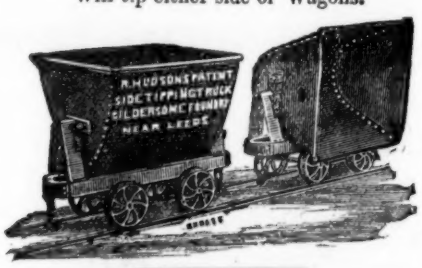


12.—PATENT STEEL HOPPER WAGON, WITH BOTTOM DOORS.

2. PATENT UNIVERSAL TRIPLE-CENTRE STEEL TIPPING TRUCK,
Will tip either SIDE or either END of rails.



8.– PATENT DOUBLE-CENTRE STEEL SIDE TIP WAGONS,
Will tip either side of Wagons.



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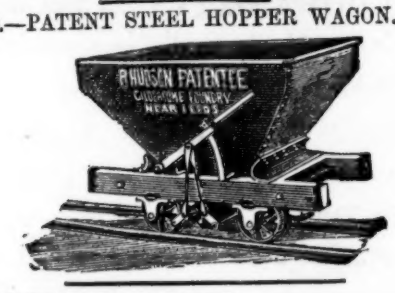
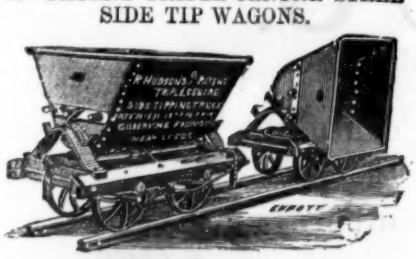
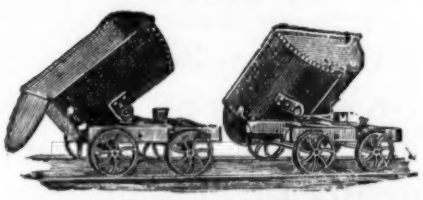


ONE man can EASILY tip ANY WEIGHT in these wagons.

3.—PATENT TRIPLE-CENTRE STEEL SIDE TIP WAGONS.

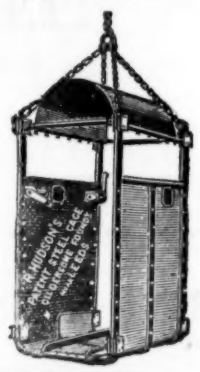


9.—PATENT STEEL ALL-ROUND TIP WAGON.



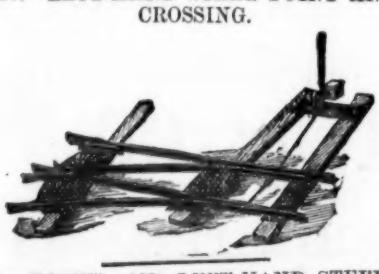
14.—SELF-RIGHTING STEEL TIP BUCKET.
(The "CATCH" can also be made SELF-ACTING if desired.)

15.—STEEL CAGE.



4. –PATENT STEEL PLATFORM OR SUGAR CANE WAGON.

10.—LEFT-HAND STEEL POINT AND CROSSING.



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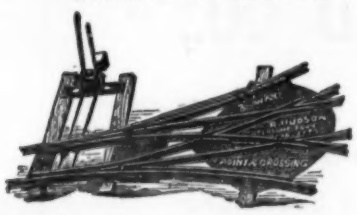
As supplied to H.M. War Office for the late war in Egypt).
DOUBLE the STRENGTH of ordinary Casks without any INCREASE in weight.
(Made from 10 gals. capacity UPWARDS to any desired size.)

11.—RIGHT AND LEFT-HAND STEEL POINT AND CROSSING.



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NO BRICKWORK REQUIRED.
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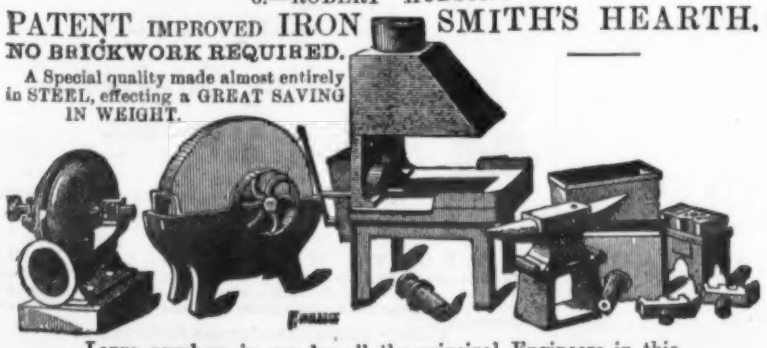

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No. 19.—PATENT STEEL CHARGING BARROW,
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18.—"AERIAL" STEEL WINDING TUB.

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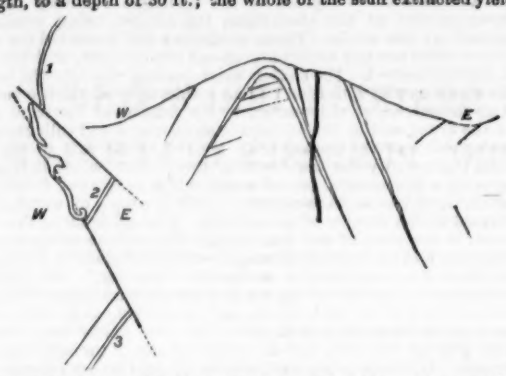
Original Correspondence.

THE GOLDEN QUARTZ REEFS OF AUSTRALIA.—No. IX.

SIR,—Garden Gully Reef, Windmill Hill Continuation.—The top of this hill consisted for the most part of a network of quartz veins, with large blocks of quartz interspersed. The richest gold-bearing stone was picked out and crushed with a hand-dolly, two miners obtaining for a period 15 ozs. of gold in this way per week, and thus enabling their mates to carry on prospecting. The claim on the top of the hill was opened to the surface for 40 ft. in width, 180 ft. in length, to a depth of 30 ft.; the whole of the stuff extracted yielded



an average of 1 oz. of gold to the ton. But below this—say, from 50 ft. to 190 ft. in depth—the width of crushing stuff taken was 70 ft., and it yielded an average of 25 dwts. per ton. But this was by no means the richest claim in the early days on this hill; on the contrary, it was considered rather a poor claim. One claim yielded nearly 500 ozs. of gold to a ton, and 54 tons gave an average yield of 75 ozs. to the ton. Other claims yielded from 40 to 50-ounce stone, and others from 20 to 40 ozs. All these claims have long since been absorbed into public companies, and many of them have from time to time yielded fair returns. The Windmill Hill continuation of reefs to the north merges into the Johnson's Reef. This latter name obtains from the foot of the Windmill Hill northwards, over the crown of the next hill. The gully running between the two hills is named Callfornia Gully, and it contained very rich alluvial deposits. The original claimholders Johnson, Early, Thorpe, Chapple, Murdoch, &c., raised large quantities of quartz that yielded rich returns of gold. I remember glancing over some of their rich heaps of quartz. It was judicious to look, but not to touch; not that the owners objected, but when so much gold was visible a natural feeling kept one from handling any of the specimens. Some of the quartz yielded up to 150 ozs. to the ton, and the ground was opened out in places 50 ft. in width, where quartz spurs occurred. Fig. 26 shows the mode of occurrence of the Johnson's Reef in the next claim north of Johnson's. It begins at 120 ft. in depth and runs down to 340 ft. At about 150 ft. in depth a slide cuts through the reef and faults it, or throws it 60 ft. from its continuation, which underlies west like to the prevailing direction of the upper portion of the reef. The reef below this fault runs down west for 33 ft., when it is again cut off by another slide. Both this and the upper slide are accompanied by a lava dyke. This fault, like the top one, is 60 ft. from one part of the broken reef to the other. The slide, however, is in this case more vertical, and it will consequently join the other one and thus form a wedge pointing to the surface in a western direction. It will be observed that frequently slides which occur not far away from one another converge upwards—that is, the wedge formed by them in the strata has its apex pointing towards the surface, and the enclosed reef and strata are faulted or moved from their original situations in the direction of the apex of the wedge, whether up or down. The thick end of the wedge in this case is downwards, and is capable of receiving pressure from a considerable area, which will have a tendency to force the wedge upwards towards the surface. It is quite evident that here too, as well as in other places on the Garden Gully line of reef previously referred to, the throw has been an upward one. The reef depicted in No. 26 is divided or faulted in three parts—the top portion is known as No. 1 reef, the next below and between the two slides as No. 2 roof, and the next deeper as No. 3 reef. The shallow part of the No. 1 reef onlyyieldedabout 10 dwts. to the ton, but the deeper part yielded as much as 20 ozs. of gold per ton, and it was rich in iron pyrites and galena. In the upper portion of the reef these minerals had been decomposed, and were absent. The cavities in the quartz previously occupied by them were filled with ferruginous clay, and the quartz was much stained by the oxides of iron, a brown or light brown colour. The No. 2 reef was formed of white quartz, containing large quantities of iron pyrites and galena, and its average produce of gold was 6 ozs. to the ton. The quartz of the No. 3 reef was very similar in character to that in No. 2, but the yield was only 2 ozs. per ton. Between the bottom of No. 1 reef and the bottom of No. 2 is a dislocated spur, in the vicinity of which the strata were very much disturbed and twisted.

It will be noticed that this occurs in almost a direct line with the lower slide, which, probably, materially aided in the distortion of the strata and the subsequent growth of the quartz spurs. This broken and twisted spur yielded some of the richest quartz ever found on Bendigo. The upper portion or first limb yielded only 6 dwts. per ton, and the second portion 20 ozs. per ton, and ¼ ton yielded 300 ozs. of gold. As usual, the rich quartz contained iron pyrites and galena. The two slides hitherto mentioned underlie to the east, but there is a third, and that makes off from the second just above where the top of the No. 3 reef begins. It underlies west parallel with the No. 3 reef, and is accompanied by a lava dyke, as are the other slides. The average thickness of No. 1 reef was 1 ft., of No. 2 2 ft., and of No. 3 about 3 ft.

The Johnson's Reef Gold Mines Company holds a large area of ground, the result of purchase from original claimholders. This mine has paid over 130,000*l.* in dividends, and other adjoining companies have paid 70,000*l.* to 45,000*l.*, and smaller sums, but at the present time the results about here, and for some distance to the north, are small. A considerable amount of sinking and cross-cutting and driving is going on in search of more golden quartz. The anticlinal in the strata further north is well marked, but in the shallower ground sandstone is the predominant rock, and the reefs are small and poor, and the country is what miners term "hungry" looking—hard dark grey sandstone. The dip of the shoots still continue north, at a small angle from the horizontal. It will no doubt be interesting to know of what constituents lower silurian slate on the Victorian gold fields consists. The following is the analysis of a black slate casing of a reef:—

Slatey matter, silicate of alumina	71·0
Carbon	17·75
Metallic iron	8·14
Oxygen moisture slow	3·11
	100·00

This casing was got from a reef at Stawell, and the following sample came from Sandhurst or Bendigo. This slate was dense in texture, of a dark blue colour, and was traversed by a thin vein of quartz containing auriferous pyrites:—

Water	4·45
Silica	62·13
Alumina	19·58
Protoxide of iron	11·04
Lime	0·33
Magnesia	1·24
Alkalies by loss	1·23, chiefly soda.
	100·00

The examinations of the water from the reefs in the lower silurian rocks proves it to be highly charged with saline matters—chlorides of sodium and magnesium, and sulphates of soda and magnesia preponderating, while the spring waters flowing from the same age rocks at a distance from the quartz reefs, as a rule, contain only small quantities of these salts, and large quantities of the carbonates of iron, lime, and magnesia.

As we go on north the reef bears the name of the Eagle or Specimen Hill. Here this line (Garden Gully) was very rich, and in all probability is still at considerable depths. The original claimholders did remarkably well for a long distance north of Specimen Hill. The anticlinal of the strata on the hill was, and is, well defined as was the saddle-formed reef, although it was not so strong as some of those at the centre and southern end of the field. The saddle being only 1 ft. 6 in. in thickness at a point about 160 yards north of the old Eagle Mining Company's shaft. The reef was opened in September, 1853, and was worked by parties of miners holding small claims varying from 12 ft. to 40 ft. in length along the line of reef. In the latter part of 1859 McNair, Caldwell, and Co., who held two of the original claims on the top of the hill purchased all the adjoining claims and prior to this period the reefs had yielded 12,500 ozs. of gold, then other 12,000 ozs. were obtained, making 24,500 ozs. I have no particulars of their output of gold during the last ten years, during which time they have, however, been prospecting the deep ground. Sketch section No. 27 shows the saddle reef or formation of the Specimen Hill Reef, with branching spurs from the western to the eastern leg. It also shows a spur dropping into the eastern leg through its hanging wall. The eastern reef underlying east is the Eagle Reef, and it is apparently the continuation of a large saddle-formed reef which overlapped the Specimen Reef. The other veins underlying west were small, but in places rich. A cross-cut put out east from the Eagle Reef cut two parallel veins close together, which will have probably intercepted these western underlying spurs should they continue downwards. Where the spurs joined the Specimen Reef they greatly increased its richness, but where this junction did not take place no change in the richness of the reef was perceptible. As much as 24 ozs. of gold have been taken out of a small windlass bucket of quartz taken from a junction of spur and reef, and at one time even double this amount was got. At one place in the cap or saddle of the reef 1 lb. weight of gold was taken from a bucket of picked stuff, and the balance crushed in a horse stamping machine of three stamp-heads crushing dry yielded 6½ ozs. of gold to the ton. This was in October, 1854.

Where the spurs joined the West Specimen Hill reef down to 50 ft. on the underlie the yield of gold ran up to 40 ozs. to the ton. Some of these spurs did not pass through the hanging-wall, but merely abutted on to it. Below this depth the character of this reef changed; it became broken up and poor. A lava dyke cut through the East Specimen Hill reef, and was in places 3 ft. in thickness. The shallower portion of the eastern leg yielded an average of 17 ozs. to the ton, and it was 2½ ft. in width. Below the lava dyke it yielded 1 oz. to the ton, and then reduced to 18 in. in width and 7 dwts. to the ton, and gradually the reef thinned to from 3 to 4 in. in width, carrying with it, however, a layer of black carbonaceous slate, which contained a very large quantity of cubical iron pyrites.

The Eagle reef averaged 2 ft. in width down to 516 ft. in depth on the underlie. To the west of the Specimen Hill reef no quartz reefs showed on the surface for some 80 yards. In the waste heaps round the old shaft I found many very perfect specimens containing graptolites (didymograpoirs) fructicosus, the most common grapto lite found in the Bendigo slates (either black slates or decomposing, and, therefore, lighter coloured). These black slates I found would precipitate gold from its solution, and this property is no doubt partly due to the graptolites so commonly found in them. I regard graptolite-bearing slates near to or adjoining a quartz reef as a good indication of its proving auriferous.

Melbourne, Nov. 18. WM. NICHOLAS, F.G.S.A.,
Consulting Mining Engineer.

QUEENSLAND SUGAR PLANT AND MACHINERY.

SIR,—Although the manufacture of sugar is not specially cognate with mining, yet, as all the machinery for it was supplied by English firms, who are doubtless readers of the *Mining Journal*, the following extract from the Sydney Morning Herald may probably prove not only interesting to them, but also to many others of your subscribers, who may not be aware of the magnitude of this new industry in Australia. The Millaquin Refinery of Messrs. Cran and Co., at Bundaberg, represents the crowning point or apex of the sugar industry in that district. It is also the reservoir whence flows the sweet product of the acres of cane which ripen in the surrounding fields, there to be turned into white crystalline grains. In the day time one sees the smoke, from its tall chimney-stack, towering 135 ft. into the air, and in the construction of which it is said 300,000 bricks were used, and at night-time its windows are aglow with light, and the fierce flames of its furnaces are reflected in the river. By day and by night the whirl and clatter of its machinery are heard. The refinery is situated on a grassy knoll or hillock by the riverside, and the steam vessels come alongside its wharf, a few hundred yards distant, and discharge their coal and receive in return cargoes of sugar. When it was determined to erect the refinery the site had to be cleared from the scrub; now it is a spot teeming with busy life. Where the trees idly dropped their faded leaves upon the river, now rise the masts of vessels, and day and night the air is filled with the voices of men and the noise of carrying and loading. Scattered round the mill are the huts and tents of the men. A dam covered with water-plants lies at the bottom of the hillock, upon the crest of which rise the tall walls of the building, with its steep roofing like the teeth of an immense saw, and circling round the foot of the rise is the dusty, cart-worn road that leads to town, about 1½ mile distant.

The refinery might be likened to a huge monster sending out feelers that suck the sugar from the fields. For miles along the roadway, through what was once the Wongarra scrub, but is now a beautiful prospect of luxuriant fields of cane, are dotted sugar mills where cane is crushed, and the juice forced by pumps through miles of pipes to the refinery. There are in all 15 miles of pipes laid from the refinery along this roadway; the refinery proprietors laying down the main system of pipes, and each millowner connects his mill with it. At each mill are a couple of tanks—used alternately—which are graduated to a certain number of gallons of juice to the inch, and into these tanks the juice flows from the rollers, lime being mixed with it on the passage. Every day an officer from the refinery visits the mills, and with a graduated rod tests the quantity of the juice in the tanks, and registers it as so many inches, and also tests and registers the density. At the office the number of gallons registered per inch and the density are calculated. The price given to the planters this season by the refinery is 17*l.* for every 2240 gallons of juice, at a standard density of 10. One per cent. is added or deducted for every tenth density above or below the standard respectively. Last season the price given at the same standard density was 22*l.* 10*s.* After the quantity of juice in the tanks at the mills has been tested by the officer the valve is turned, and the juice is then pumped through the pipes to the refinery, whence we will follow it.

The juice gathered by this system of reticulation is discharged at the refinery into a reservoir or tank, capable of containing 50,000 gallons, and situated on the ground floor. Leaving it here for a minute we go down to the river bank, where several punts are moored. Each of these punts contains three tanks, capable of holding, in all, 10,000 gallons, and they are filled with juice brought from the mills along the river bank. At the refinery wharf the juice is carried from the punt tanks by a pump worked by a water-wheel, which is turned by overflow water from the building. This juice passes into a reservoir similar to that in which is collected the juice from the pipes.

From these reservoirs the juice flows into two working tanks of a capacity of 25,000 gallons each. In connection with these is a lime-puddling or mixing mill, from which lime is passed into the working tanks, and is there stirred round by an agitator revolving in the centre of each tank. The juice, when fully impregnated with lime, is pumped up to the gasing tanks on a storey above. There are four of these tanks, each containing a charge about 2000 gallons, Here carbonic acid gas is injected into the juice in order to carbonate the lime, and when this has been done the juice is passed into pressure pans, where it is properly boiled. There are two of these pans worked alternately, they being heated by copper steam coils. From the pressure pans the juice passes into the *mont jus*, and is forced by it into a set of nine filter presses, each having 30 plates or faces of canvas through which the juice is filtered. After passing through the filter presses it flows through a set of Taylor's filters—a series of long round canvas tubes containing folds of filter cloth. The juice is once more collected in tanks or subsiders, and is subjected to a second gasing till it is thoroughly impregnated with carbonic acid in order to destroy every atom of lime it may contain. It is then once more boiled, this time with the object of driving off or setting free any excess of carbonic acid gas that may be contained in it. It is then pumped through another set of filter presses, with plates of much finer cloth than that contained in the first set. Thence it is pumped into the supply tank, whence the triple effets, of which there are two sets, draw their supply. The triple effets are worked by the exhaust steam from the engine, so that practically their only cost of working is the wage of the man who attends to them. Thence the syrup, as the juice is now called, flows to the charcoal filters, of which there are 12, each 32 ft. in depth, and filled with animal charcoal to within about 15 in. of the top margins. Through these filters the syrup—which, by-the-bye, was sent through a heater on its passage from the triple effets—slowly percolates, and when drawn off at the bottom has the colour of bright, clear sherry. The charcoal, after use, is returned, and can be so heated time after time. From the charcoal filters the syrup is pumped into the vacuum-pans, of which there are two, one being 20 ton and the other 10 ton in capacity. It is here boiled in vacuo to granulation, and is then discharged into a pug-mill; thence, by gravitation, it flows into six of Weston's largest (48 in. in diameter) centrifugals, whence the sugar is discharged at the bottom on to an endless belt, which takes it to a cup and chain elevator, and it is thus carried to the upper sugar-room, where it is emptied into a mixer. The sugar then passes down a shoot at the bottom of which it is bagged and stacked. A tramway from the sugar-room conveys it to the wharf, and there it is placed in a steamer, where we leave it after having followed it through its devious course from field to ship.

Some idea of the extent of the refinery may be gathered from the following facts:—The building is divided into four compartments, the main portion or body being occupied by the principal machinery, whilst to one side are the charcoal filter-works, and to the other the sugar rooms, each of which latter measure 250 ft. in length and 50 ft. in breadth, and are capable of storing 4000 tons of sugar. The average output of sugar is from 250 to 270 tons a week, the refinery going night and day. Last season the refinery was at work for about eight months. The average quantity of juice received at the mill per day (24 hours) of last month (August) was 71,500 gallons. The engines are worked by seven boilers, each with two fires, about 300 tons of coal being consumed per week. The coal, by an ingenious contrivance, is carried from the vessel to a large shed above the boilers, and thence shoots bring it down to a space immediately in front of each boiler, whence it can be thrown without further trouble into the furnaces. The coal is supplied per A. S. N. Company's boats from Newcastle, and the lime in connection with the lime-works is brought from Rockhampton. I noticed a very ingenious contrivance in connection with the limekiln. It was for hoisting the stone to the top of the kiln. A stage was erected such a height as to permit a cage to be drawn up so as to discharge its contents into the top or mouth of the kiln. A chain was passed over a pulley, and attached at one end to a cage or iron box at the top of the kiln, the other end being attached to one at the bottom. When the bottom box was filled with stone a water pipe was turned into the one at the top, and it was filled till the weight of the water was sufficient to weigh up the load of stone. When it reached the bottom the water was discharged, the box filled with stone, and the one above, which meantime had been unloaded, was in its turn filled with water. It is by means of such labour-saving appliances, and application of thought and ingenuity, that the work of the refinery is carried out so well and so smoothly. In the evening the whole of the mill is lit up with gas made on the premises. There are in conection with the works about 140 white and 20 coloured men employed. Fresh water is supplied from a dam at the rear of the building, and also from a sort of reservoir formed some distance away by damming across a stream flowing into the river. Salt water is pumped up from the river itself.

The following is a list of the principal plantations on the main road through Woongarra, which send their juice to the refinery by means of pipes:—Messrs. H. J. Rhodes and Co., Sydney, The Hummock; Cran Brothers and Co., Duncraggan; Nott Brothers, of Windermere; the Rev. Ed. Tanner, The Grange; Messrs. Buss and Turner, M. Stanig, S. Rowe, and Young Brothers' plantations, and others. Juice is carried by the barges from the following:—Messrs. A. H. and E. Young, Fairymead; John Forrest and Co., Avoca; F. W. Gladwell, Mabbro; Buchanan and Denny, Oakwood. In many cases the mills in connection with these plantations crush for small growers, so that the whole represents a thoroughly central system, from which the smallest as well as the largest cultivator of cane derives benefit.

Fiji, also, is rapidly bearing a large produce of sugar, and there is now one of the most extensive and powerful plants in the world erected there, and in full working order, by the Sydney Sugar Refining Company, which also owns a perfect fleet of Drogher's punts, and first-class ocean going steamers in connection with their factories there, and in Queensland and New South Wales. R. D. A.

Sydney, November 9.

THE NORTHERN TERRITORY GOLD FIELDS, AUSTRALIA.

SIR,—As there has been so many losses in gold mining investments in India and Africa under inexperienced management, it may not be uninteresting to notice a few facts in reference to the production of gold in this part of Australia. The gold fields of the Northern Territory were discovered about 10 years' since, and have been gradually developed under the usual difficulties attending the opening of new countries where the population is small and appliances limited, but within the last two years the success of several steadily worked mines have become so assured that the future prosperity of these gold fields may be deemed a certainty and are likely to attract some attention in the mining world. A number of rich quartz mines have been in work for some time past with most favourable results, and so encouraging are the general prospects of the several gold producing mines that the Government of South Australia have commenced the making of the Transcontinental Railway from Palmerston (Port Darwin) to Pine Creek.

The quarterly report Aug. 12 says:—"The quantity of gold exported during the quarter, 8225 ozs., value 29,424*l.*, is conclusive proof of the richness of the few claims now worked. The escort during the week brought down 1732 ozs., chiefly reef gold; Jansen, Pine Creek, 388 ozs.; Spring Hill Co. Twelve Mill, 316 ozs.; Pine Que, Union, 221 ozs.; and M'Intyre Extended, 133 ozs. These claims are undoubtedly very valuable properties."

The Northern Territory Times and Gazette, Aug. 30, says:—"At the present time all the mining machinery in the country is kept at work, and all the reefs being operated on are turning out well, the average yield being about 2 ozs. of gold per ton."

As an instance one company at Jam Creek commenced crushing in the latter end of 1882, and the first 520 tons of quartz gave a yield of about 900 ozs. smelted gold; similar yields have from that time been obtained, while the development of the several lodes by shaft sinking and mining works have been successfully carried on showing, now it is reported, in the present workings over 3000 tons of quartz in sight that will average 1½ oz. gold per ton. The reefs average from 4 to 12 ft. in width, and the supply of quartz is sufficient to keep a stamp mill of 40 to 50 heads in full work, which would crush from 400 to 500 tons of quartz per week.

Later information from the mine gives results as follows:—June 28: Six weeks crushing (with only 10 head mill) 680 ozs. The last four weeks 514 ozs., value 1877*l.* Costs for the month being 742*l.*; profit, 1135*l.* The stone from the lowest level is now turning out 2 ozs. per ton.—July, 4: The Northern Australian, Palmerston,

says—The . . . claim is looking grand—as good as gold. They are down 160 ft., and the reef is 12 ft. wide.—July 26: A telegram from the . . . claim says—Four weeks work 408 ozs.; value, 1507*l.*; costs, 580*l.*; profit, 927*l.*—Aug. 26: Says—Cleared a further 1000*l.* for four weeks. I have been informed by competent authorities that there is ample stone to keep 50 head of stampers at work, which would give a profit of 5000*l.* a month.

There are many similar mines in the district, and the Northern Territory only wants capital, labour, and machinery to make it a very productive and highly profitable gold producing colony. These gold fields offer unbounded resources for the profitable investment of capital under careful supervision and management.

Should any of your readers be desirous of information relative to the merits of these gold fields as a safe and reliable investment, I can give some facts of present yields and profits as are of a most encouraging nature.

THOMAS CORNISH, M.E.,
Author of "Our Gold Supply: Its Effects on Finance, Trade, Commerce, and Industries."

COLORADO MINES.—No. XXVII.—GOLD FROM GRINDSTONES.

SIR,—The early geologists taught gold was only to be found in the primitive or transition rocks, and this only to a comparatively shallow depth. Both suppositions are now proved to be erroneous, although we must admit its birthplace is in the oldest formations. We now find rich gold in fine grit sandstone of modern age; also in cemented gravels. I am led to notice this from a valuable discovery made recently here in one of the spurs of the snowy range several hundred feet above the valley of the creek; but the form in which it is found is somewhat singular, and has given rise to a good deal of controversy among local scientists. These mountains consist of only two systems—the devonian above and silurian below. The former is nearly horizontal, and the latter vertical in their deposition. Thus they repose unconformably on each other, making the division very distinct and well defined; the lithology of the devonian may be described as consisting almost entirely of limestones, shales, trachyte, and heavy beds of massive quartzite. Porphyry dykes thrust themselves entirely through the strata, which are chiefly lead and silver bearing, but the quartzite contains copper and some gold. The silurian is composed of granite-gneiss, hornblendic rock and vein quartz, porphyry, syenite, and felspar, but very little lime, all are highly silicious. In these rocks are found almost every kind of metallic mineral known to the metallurgist. Some few weeks ago, a gentleman brought me some rock, and asked me my opinion of it, I told him it was devonian sandstone, he said it contained gold, although none was visible to the naked eye; I said we would try it in the pan. Well, it was pounded down in my mortar, and very carefully panned out, when to my astonishment it yielded free gold equivalent to 22 ozs. to the ton. It was in a neighbouring mining town a very comical thing occurred some few years ago. which led to numerous jokes; one of the resident assayers was proverbial for always giving high figured certificates. It mattered but little what the ore was, where it came from, or to whom it belonged. His object in doing this was said to please his customers—a thing not entirely confined to Colorado assayers. One day a party brought him some samples of ore for testing; they had very little faith of its containing gold of much value; to their astonishment he rendered a certificate showing the specimens to be exceedingly rich. This, of course, they did not believe. They now concocted a scheme to test the merits of the assayer. They procured part of an old broken grindstone, pounded it up, and sent it to him, with instructions to be very careful in the assay, as it came from the same mine as the other samples of which he had given such a good report. In due time a certificate was handed them, giving as a result of his assay over "3 ozs." of gold to the ton. This evidence of the assayer's talent was conclusive. Now, we must not always judge from pre-conceived opinions. Had I been told in my younger days that a piece of common sandstone contained gold in paying quantities I should have treated the assertion as an absolute absurdity. I should not do so now. Let us suppose some of these Rocky Mountain sandstones were cut into the shape of a common grindstone, and a beautiful fine-cutting grinder it would be, break it up, and have the fractured pieces assayed; it would be only sandstone still whatever its shape, but the contents of the crucible would astonish the most sceptical; seeing is believing. Here is the stone, and here is the gold in fine glittering grains, but the mystery is how came it in such a questionable shape. If we carefully investigate this matter I think the problem may be solved very easily. It must first be understood that through this mountain runs a large porphyry dyke, which is traversed by a vein or small lode about 14 in. thick above the dyke all the ground is of a decomposed quartzite, which all here know contains traces of gold. This vein was at one time an open fissure, and received the water percolating through the disintegrated silicious strata above. Now, according to the natural law of affinity in all earthly things, each for its kind, molecular attraction takes place, and, like other metals, "gold grows," and the most minute atoms in the auriferous waters they enlarge in size, although first only in solution; hence the presence of nuggets and coarse grains of gold in our alluvial placer diggings. Again, the porphyries, although not containing any of the precious metals in themselves, exert a very powerful influence in their deposition. This is quite accountable for by the powerful electric currents that flow or pass through all polar courses of mineral veins. Now as this can be demonstrated in the laboratory I think the proof admits of no contradiction, therefore the case above quoted of the poor unfortunate assayer, that afforded matter for ridicule, and which seemed so improbable, may not be impossible, for I know of several places in Colorado where the sandstone bedrock of the creeks contain sufficient gold to pay well for running through the stamp mill.

Alma, Colorado, Dec. 5. CHARLES S. RICHARDSON, G.M.E.

DEVELOPMENT OF THE SOUTH YORKSHIRE COAL TRADE.

SIR,—The richest carboniferous deposits in the Midland coal field, it is stated, will proximately enjoy a much shorter and uninterrupted communication with the sea, culminating in a greatly reduced cost of transit to the Metropolis upon any existing system by sea or rail. The Hull and Barnsley Railway under construction, the Manchester, Sheffield, and Lincolnshire to Grimsby, and the Great Northern to the Wash, have close upon 60 miles lead to port of shipment, all with tidal dock detention, whereas the mean of the dual lines from Rotherham and Bawtry to Trent is merely one-fourth of the distance, endowed with every facility for cheap construction, transport, and shipment, untramelled with the cost and ingress and egress detention inseparable from a dock which would render commercially impracticable from the Trent the supplying of London with coal upon a large scale. Keadby, on the Trent, has no dock, where the Manchester, Sheffield, and Lincolnshire Railway Company ship annually 300,000 tons of coal to Hull. There is no doubt but that West Stockwith and Keadby, the two Trent coal shipping ports, are destined to be the great outlets for the Yorkshire house, steam, and gas coal, and coke, which is an old aspiration of the coalowners of that district. The largest class of ocean steamers will load from barges in the Humber, the shortest sea distance from the Thames. Boston, once advocated by Mr. Thompson, has an immense land carriage, which will prevent any semblance of competition with the Rotherham to Trent Railways.

The Parliamentary evidence of the well-known mining engineers, Mr. J. E. Mammatt and Mr. J. O. Greaves, estimates the quantity of workable coal, comprising the Silkstone, Barnsley, and other first-class seams, within one mile of the two companies' lines, amounts to upwards of 700,000,000—say seven hundred million—tons, and within five miles 3,500,000,000—say three billion five hundred million—tons, a practically inexhaustible quantity. According to the report of a Royal Commission, the productive coal measures exist under the entire system.

The Taff Vale and the Blyth and Tyne (the latter merged in the North Eastern) coal-carrying lines to the sea for export, pay by far the highest dividends in the kingdom, at a cost per mile of double what the Rotherham to Trent lines are estimated to cost. Every praise to the far-seeing and enterprising Earl of Scarborough, who, in augmenting his princely revenue by causing his vast Royalty to be brought into direct communication by sea with London simultaneously with the Duke of Norfolk, Sir George Sitwell, Bart., and other notabilities, will confer the greatest possible boon on the huge population of the metropolis.

AN OLD CONTRIBUTOR.

ELECTRO-AMALGAMATION OF GOLD.

SIR,—Hitherto electro-amalgamation has not proved a great success, so far as I can learn; but from the results which I recollect to have been obtained by the late Mr. John Calvert some 30 years ago, I thought at the time that, although the method by which Mr. Calvert drew out the gold in the shape of beads on the surface of the quartz was a mystery, there must be something in electric extraction of gold, though I naturally then knew nothing of electro-amalgamation. I am glad to find that recent non-success has not deterred others from trying in the same direction, and I trust their results may be more satisfactory. I have read all that has been stated in the *Mining Journal* about the care that should be taken not to trouble ourselves about leaving a few grains of gold in the quartz if the extraction of them costs more than the extracted gold can be sold for; but it seems to me that, if the auriferous stuff passes through the mercury, there is no valid reason why any should be permitted to escape. I have just been asked for an opinion upon the electro process patented about a year ago by Mr. B. C. Molloy, M.P., and which, I understand, was especially designed for turning to account the rich auriferous deposits of county Wicklow, which, I may mention, is an undoubtedly gold-bearing district of Ireland, but one which has never received proper attention from either Irishmen or Englishmen, albeit it is far richer for gold than either India or the Transvaal. Now Mr. Molloy declares the object of his invention, and as he is a barrister I suppose he would be legally accurate in his declarations to be to increase by amalgamation the quantity of gold and other metals obtainable from compounds containing such metals. If he can do this wth the Wicklow ore we may yet have a special mint in Ireland for coining Irish gold, just as they have mints in Sydney and Melbourne for coining Australian sovereigns from Australian gold.

I need not remind my readers that in some recent sparring in the *Mining Journal*, Mr. Moon—and he is no lunatic, in spite of his name—demonstrated, or if he did not demonstrate he stated, which nowadays often passes for the same thing, that Mr. Readwin was wrong in supposing that mercury sickened or floured except through rank carelessness; yet Mr. Molloy says that he attains his result by preventing the sickening and flouring of the mercury, and increasing the contact between the gold and other metals in the particles of the ore or other compound and the fluid metal. But must not a thing be on the eve of occurring before it can be prevented, or to be more accurate is a patent necessary to prevent something that never will occur under any circumstances; hence the inevitable conclusion that since Mr. Molloy prevents the sickening and flouring of the mercury, therefore mercury sometimes sickens. Mr. Molloy then states that he employs a box of suitable shape and convenient dimensions, and constructed of wood or other suitable material saturated or coated with a waterproofing material such as paraffin, wax, shellac, or marine glue. This box is provided with a wide-mouthed opening so shaped as to form a sloping table down which the stream of ore to be treated runs to a drum, and the other end of the box may conveniently be shaped so as to form a sloping table down which the ore treated is carried away. The central portion of the box is closed, except the two ends, as above specified. The depth of the closed part of the box may be 3-8 of an inch. In the wide-mouthed opening is fitted a drum the width of the box working to within ¼ of an inch of the bottom. In the other wide-mouthed end of the box is another drum working under similar conditions. An endless band of suitable material passes over the first drum, then through the canal or closed central part of the box, and then around the second drum and back again overhead to the first drum. Mercury is placed in the box so as to rise above the openings at each end of the central closed part of the box. The bottom of the box is closed with a leather or other suitable porous material. This porous diaphragm intervenes between the mercury and electrolyte, which under electrical action will give hydrogen at the surface of the mercury. The electrolyte is, therefore, contained in another vessel, so that the diaphragm is in contact with the electrolyte.

The simplicity of the apparatus and the small first cost would, it must be acknowledged, be a great recommendation, because the Molloy apparatus could be constructed and used at the mine where the ore might be produced, and if the inventor were to charge only a small royalty based upon the gold saved he would make a rapid fortune. He explains that when the apparatus is arranged as described the mercury which now constitutes a cathode is fitted with a platinum or other electrical connection, and the electrolyte is also supplied with a suitable anode. Inclination may be given to the diaphragm when necessary to facilitate escape of oxygen evolved from the anode. The apparatus being arranged, and the electrical connections duly made then the current of electricity of 4 volts or upwards will pass from the anode through the aqueous electrolyte to the mercury cathode and produce the desired hydrogen amalgam at the expense of the hydrogen resulting from the decomposition of the electrolyte the oxygen being retained or evolved at the anode. These conditions being secured the slimes (*i.e.*, the crushed ore and water) are passed into the box, and the drum is slowly revolved. The endless band passing through the body of the slimes carries with it on its face a thin layer of the ore and takes it through the canal to the other open end of the box where it floats to the surface of the mercury and passes away by means of a trough, or by other convenient arrangement. By these means the particles of gold or ore carrying gold and all float gold will be brought into intimate contact with and rolled in the body of the mercury maintained in a quick or unsickened condition by the action of the current of electricity. The ore so discharged will have thus passed through a considerable quantity or length of mercury, by which a prolonged contact between the mercury and the ore will have been secured, and the duration of contact may readily be varied.

To enter somewhat more fully into details, it may be mentioned that the exit of the box is slightly higher than the surface of the mercury, so that there is no waste of that metal. The body of mercury has an electrical connection which may be formed by a platinum wire resting in the mercury and passing through the substance of the box at any convenient point. The mercury here will constitute the cathode, and is connected by means of the platinum wire with the zinc or negative pole of a voltaic battery of two or more couples in series, or with the negative pole of any other electro motor, such as a dynamo machine, while the carbon or other anode in the trough is connected with the positive pole of the same electro motor. A slight inclination should be given to the diaphragm where necessary, to prevent the accumulation of oxygen on its under surface, and outlets for escape should be made. When the electrolyte is, for instance, dilute sulphuric acid, then the evolution of oxygen may be entirely avoided by the use of the metal lead as the positive electrode or anode, in which case a peroxide of this metal is formed. In this latter case the lead anode may coveniently be coated with porous lead This can be easily obtained by precipitating by means of zinc porous lead from the acetate or other soluble salt of the metal, and the aqueous electrolyte contained in the trough may be any which will give hydrogen at the mercury cathode, or hydrogen, and at metal electro positive to hydrogen. For example, sulphuric acid diluted with 12 parts of water to give hydrogen at the cathode, or a solution of caustic soda, or of a salt of soda, to give hydrogen and sodium at the cathode. When the apparatus is in action, for example with a solution of caustic soda, he uses an electro motive force, which in ordinary cases need be no higher than 4 volts. This electromotive force will cause the evolution of hydrogen at the cathode (such evolved hydrogen being the excess of the quantity required to form hydrogen amalgam) and a small proportion of the alkaline metal will also be separated. An amalgam of sodium and mercury containing but a small proportion of the former metal would, when used as a positive element in conjunction with a carbon negative and an aqueous electrolyte, give an opposing electromotive force of less than 3 volts, such an amalgam could therefore, as is well understood, be obtained by means of an electromotive force of 4 volts.

The electrical resistance in the circuit constituted by the apparatus being very small electrical power is not wasted; yet it must be understood that Mr. Molloy does not limit himself to any definite electromotive force; but in every case it must be greater than the counter electromotive force generated within the apparatus itself. When dilute sulphuric acid is the electrolyte he prefers to use an anode of lead, but when the electrolyte is an alkaline solution this metal should not be employed. In such a case he prefers to employ carbon platinum or copper. The apparatus being thus so far arranged and the electrical connections duly made then the current of electricity will pass from the anode in the trough through the aqueous electrolyte to the mercury cathode and produce the desired hydrogen amalgam at the expense of the hydrogen resulting from the decomposition of the electrolyte, the oxygen being retained or evolved at the anode. These conditions being secured the slimes (the crushed ore and water) are passed into the box, and the drum is slowly revolved. The endless band passing through the body of the slimes carries with it on its face a thin layer of the ore and rolls it on the surface of the mercury by the pressure of the band or face of the drum, and by the rolling action separates and rolls separately each particle of the crushed ore. Arrived at the exit of the band from the mercury the ore floats to the surface, where it is played upon by a fine spray or jets of water, which shoots out from a tube which is, of course, in connection with a supply of water, and is pierced with a number of small holes. This agitation of the ore by water at the point of exit disentangles the particles of ore from the mercury, and enables it to float away without disturbing the mercury and so avoids the otherwise mechanical "flouring." The difference in the specific gravity of the ore and the mercury makes the separation of the ore and the mercury, and the carrying away of the former easy under the conditions named. The ore passes away over the exit side of the box, and is conducted away through a suitable trough. By these means the particles of gold or ore carrying gold, and all float gold will be brought into intimate contact with and rolled in the body of the mercury maintained in a "quick" or "unsickened" condition. The ore so discharged will have thus passed through and been rolled over and against a considerable quantity or surface of mercury by which a prolonged contact between the mercury and the ore will have been secured, and the duration of contact may readily be varied for from 5 to 30 seconds or longer.

That this apparatus will be successful in practice I do not doubt, and I think there is more in it than even the inventor may have noticed. The application of the electricity was, as I have already observed, successful in the hands of the late John Calvert, and the endless band is really carrying out the suggestion of the late Evan Hopkins, though in a clumsy way—he proposed flaps or shutters covered with silk to dip into the mercury, so that the ore in its finely divided state, and from which the gold was to be separated should be compelled to pass down into the mercury twice or thrice in its way from the inlet to the exit end of the box; and he stated that in actual practice this had succeeded thoroughly.

T. C. B.

South Circular-road, Dublin, Dec. 20.

MANUFACTURING WHITE LEAD.

SIR,—We are all anxiously awaiting an improvement in the price of lead, and it will no doubt come at last, as it has before; but it seems curious that no greater efforts are made to secure its wider application to useful purposes. Correspondents occupy your valuable space with descriptions of antiquated substitutes for the steam whistle on railways, though this whistle is music indeed in the manufacturing districts, since it sings of activity in the factories, and of plenty of food and firing in the homes of the workpeople. I fear we are getting too many of those nervous old cronies in England who faint at the sound of a steam whistle or even of a cock crowing; they are worse than poor old Organ Grinding Babbage, F.R.S., because they produce nothing useful in compensation for their imbecility. We want more active business men—men who will say:—"Well, lead is only 10*l.* per ton; therefore, we must produce it at 9*l.* 10s., so as to have 10s. profit, and we must let the men earn as much each week by working a little harder, so as to get a larger number of tons." Miners do not mind working harder to meet hard times, and if users could rely upon a regular supply of lead at 10*l.* per ton it would be put to many uses for which it is not now thought of. We must find out, too, how to make pig-lead more cheaply by using improved processes, and when we have got cheap pig-lead we must make cheap lead products from them. It was probably because he took this view that Mr. James Kay, of this town, set about simplifying the white lead manufacture in order to lessen its cost of production, and the question is why so simple an arrangement was not adopted before. He carries the wicket lead from the stack-house to the breaker or crushing-mill by means of an endless belt. For crushing one or more pairs of rollers working horizontally with scraper attached to each roller may be employed, but he uses by preference three pairs of rollers. Instead of using a breaker or crushing-mill an ordinary grinding mill may be used, with granite or cast-iron rollers working on granite slab, or working in cast-iron dish or basin, but he prefers the breaker or crushing-mill with three pairs of rollers working horizontally.

The lead, after having been broken or crushed in the mill, passes into the upper end of a revolving perforated cylinder or screen working at an angle and open at both ends; fixed into this revolving perforated cylinder or screen are a number of spikes or projections so distributed as to prevent the lead from being carried too rapidly through the revolving perforated cylinder or screen, and to act as breakers. The blue lead from the revolving perforated cylinder or screen working at an angle is shot out at the lower end, and if not thoroughly screened may fall into a second revolving perforated cylinder or screen working at an angle similar to the first, and undergo a process like that already described. The blue lead after having been thoroughly screened is shot out at the lower end of the revolving perforated cylinder or screen into the receiver for removal to furnace. The dust or powdered lead, after passing through the perforations in the revolving cylinder or screen working at an angle falls into a receiver, and from the receiver into a hopper with feed roller, and from thence to the rollers of the grinding machine, one or more pairs of grinding rollers may be employed, but he uses by preference three pairs of grinding rollers: in each pair of rollers in the grinding machine each roller is made to slide horizontally in the opposite direction to the other roller, thus giving greater grinding power, and keeping the rollers in the machine true one with another. The dust or powdered lead after having passed through the nip of the first pair of grinding rollers is scraped off the rollers, and falls into the nip of the second pair, and so on until thoroughly ground, when it falls into a receiver, and is ready for removal to the packing-room. Instead of using a revolving perforated cylinder working at an angle, a revolving perforated conical cylinder may be employed with spikes or projections, the lead would pass from the breaker or crushing mill into the small end of the perforated conical cylinder or screen, the blue lead when screened would pass out at the large end, and the dust or powdered lead fall through the perforations into receiver below. The different machines are cased with wood, or other suitable material, to prevent the dust or powderedl ead from flying about.

Here, then, we have a cheap method of making white-lead, and what I want to know is why we do not use some such process—I do not advocate Mr. Kay's in particular—so that white-lead may be sold for white-lead as it used to be before we were so scientifically clever. It is not because less products, supposed to be lead products, are now bought than formerly that prices have gone down, but because we now never sell what we pretend to sell. Our white-lead (?) is almost all baryta, sometimes sulphate, sometimes carbonate; our white paper (?) is chiefly china-clay; our brown paper (?) is to a large extent portland cement, and so we might go on to the end of the chapter. And what is the result? Why, miners have to content themselves or starve with raising a ton of baryta for 1s. (because it will only sell for 1*l.*) instead of getting 10s. for raising a ton of lead ore, which will sell for 6*l.* or 7*l.*, so that by defrauding the consumer of white-lead, or what should be white-lead, the miner is starved instead of being kept well employed at good wages. It is another evidence of the truth that "Honesty is the best policy." If the manufacturers of lead products were honest and made them from

lead only they would, perhaps, recover markets they have now lost and working lead miners would be better paid. JUSTICE.
Bury, Dec. 8.

THE LONDON ACADEMIC UNIVERSITY.

The evil inseparable from the paper-university system—that of granting university degrees for transient efforts of memory instead of for honest study and sound knowledge—has always been condemned in the columns of the *Mining Journal*, so that the renewed recognition of the fact that old "Stinkamalee," as the original Gower-street University of London was contemptuously called, was, after all, the best substitute for a university of the class to which those of Oxford, Cambridge, Dublin, and Durham belong, that could be devised is particularly gratifying; though in asking for an endowment of 50,000*l.* per annum the promoters of the new scheme for a Teaching University for London have probably rendered the success of the project impracticable. The gradual development of Stinkamalee into the present Burlington House institution cannot be more briefly or more neatly given than in last week's Athenæum:—As everyone knows, the present examining University of London was the result of a compromise between the rival claims of the Church and the Dissenters. Churchmen objected to the secular character of London University, which had been set on foot in Gower-street, and not only founded King's College, but protested against a charter being given to the University; and the Government of the day, yielding to the outcry raised against a godless university, determined that a new body should be founded by the Crown, which should examine the students of the University of London (henceforth called University College) and King's College. The teaching was to be done by the colleges. Subsequently various other institutions in different parts of England were affiliated to the examining University, and finally the University decided to give its degrees to anyone who would pass its examinations, without exacting any guarantees of training from the candidate. It has long been felt that this system is most unsatisfactory. The examinations have become an end instead of a means, and the preparation for them has fallen largely into the hands of crammers, whose business it is, whether they like it or no, not to educate their pupils, but to teach them to outwit an examiner who has no personal knowledge of them, and has no means of judging their capabilities except from their written answers to a few questions. On the other hand, the usefulness of the two colleges has suffered greatly from the cessation of their connection with the examining body. They are forced to conform their teaching to the requirements of a board with which they have no communication, while many of its regulations are ill suited to their needs. The two colleges, University and King's, have also languished for lack of means, and they lately applied to the City Companies Commission for an endowment out of the funds of the companies. They greatly needed such assistance, and their efficiency would be still further enhanced if the natural connection between them and the University were restored.

We should be disinclined to go with the Athenæum so far as to declare that "there is no need for the continuance of the present system at Burlington Gardens," as the present University of London, no doubt, meets the views and wants of many whose opinions would altogether exclude them from an academic university, upon however broad a basis it might be organised. To abolish the present University of London (which, by the way, is not proposed) would but revive all the plebeian ill-feeling against universities generally which was displayed at the commencement of the second quarter of the present century, and would render the grant of any privileges to a Teaching University of London absolutely intolerable to the masses. A somewhat similar effort to that now under consideration was made a few years since in Nova Scotia, by the establishment of the University of Halifax, the object of which was to consolidate and improve the teaching power of the several older universities in the province; but the result was a signal failure, although the Government endowments were withdrawn from the latter institutions in order, if possible, to force them to consolidate themselves with the University of Halifax, and the failure of the Teaching University for London will, if carried out as at present proposed, be equally complete. The Association formed for promoting the London scheme held a meeting at the Society of Arts on Monday evening, and the sub-committee's proposed plan then submitted removes the last doubt, if any still existed, as to the utter impracticability of the project. The new university would retain all the objections to the present University of London, and would possess none of its merits.

With regard to the constitution of the university it is proposed that it shall be founded on:—1. The Faculties or Constituent Bodies; 2. A Board of Studies for each Faculty; 3. A Governing Body or Council.—1. The Council, to consist of members representative of; (a) The several faculties (the proportion of representatives of the faculties to the whole number of the Council to be at least one-third; (b) the Senate of the University of London; (c) the Council of Legal Education; (d) the Royal Colleges of Physicians and Surgeons; (e) it should be a point for future consideration whether other public bodies should be directly represented on the Council, *e.g.*, the authorities of the British Museum, of the Royal Academy and Royal Society, of the Incorporated Law Society, and of the Institute of Civil Engineers; (f) Colleges and other educational institutions associated with the University (the amount of representation and the qualification for direct representation on the Council to be determined in each case, having regard both to the nature and the amount of the educational work performed by the Associated Institution); (g) endowing bodies (*e.g.*, the Crown if the Teaching University should receive State endowment, the Corporation and Companies of the City of London if they contribute to endow the University). Representatives of associated institutions and endowing bodies not to exceed one-third of the whole number of places on the Council.—2. The Boards of Studies—To be elected by each faculty.—Some additional members might be appointed by the Council. The board to advise in all matters relating to the faculty, and to exercise authority in such matters as are delegated to it by the Council. Facilities to be provided for joint meetings and action of two or more Boards of Studies when necessary. The board to appoint some or all of the representatives of the faculty upon the Council. If they are appointed by the faculty direct they should also be *ex officio* members of the board. 3. The Faculties—to consist for electing purposes of—(a) Teachers; being professors, lecturers, or persons of equivalent standing, in the colleges or educational institutions associated with the University; (b) Examiners for the time being in the Teaching University and in the existing University; (c) Additional members, to be appointed by the Council, on the recommendation of the Board of Studies. There might also be honorary members of faculties, including graduates in that faculty, of the Teaching University; members of convocation of the existing University according to their degrees; recipients of degrees *honoris causa*, and so forth; such honorary members having the right to attend, and vote only at a general meeting of the faculty, to be summoned on requisition when necessary.

The proposed relations of the Teaching University with other bodies are such that harmony could scarcely be hoped for up to the date of the first Degree day, should that period ever be reached. 1. The Existing University.—There might be one chancellor, with two vice-chancellors, the Teaching University and existing University constituting one University in two departments. The degrees might, if necessary, be distinguished by their designation in some suitable manner. The senate of the existing University would remain unaltered, would be appointed as at present, and would control the present examinations and confer degrees without interference. Convocation might accept the graduates of the Teaching University as full members. The Teaching University might, so far as is practicable, find a place of meeting at Burlington House, together with the existing University. 2. The Professional Corporations.—Degrees in law, medicine, and surgery to be recognised as qualifying *pro tanto* for the call to the bar or for license to practise, the power of calling to the bar or of conferring licenses to practise being reserved to the existing authorities. The previous examinations of the Teaching University to receive recognition by those authorities, such as is now given to the examinations of existing Universities.

As to the work of the University, it is proposed that the Teaching University shall obtain power to confer the usual degrees, either by way of supplemental charter to the University of London or otherwise, after such course of study and examination as may be determined on. As means and opportunity will allow, the Teaching University to appoint professors in the more advanced studies, and for purposes of original research. The Council to negociate with associated institutions for the increase of facilities for common attendance at lectures, laboratory work, and admission to libraries and museums, and for the concentration of teaching within one or more of such institutions, or within the University itself, in such studies as may appear desirable. The extent to which it may be found possible to blend the examinations of the Teaching University with those of the existing University, of the professional corporations, or of other examining bodies, to be determined hereafter, full liberty of action being reserved to the respective authorities. Professors, lecturers, &c., who are members of the faculty, to have the title of "professor, lecturer, &c., of (or on)" in the proposed University; the first blank denoting the college or institution with which they are connected, preceded by the title (if any) by which their chair or other office is known. Students in associated institutions and special schools to be at liberty to become undergraduates in the Teaching University, or to obtain degrees as at present from the existing University.

The speech with which the report was presented by the Chairman (Lord Reay) was nicely delivered; but unfortunately many of the statements which he submitted as facts are not facts at all, his conclusions are not always deducible from his premises, and in very many cases his statements are literally true but substantially false. His lordship stated that London was at this moment in an entirely exceptional position. London had the best professors, lecturers, and examiners, the best collections of science and art, and the best libraries. If an ideal university was a university which had the best teachers and the best collections, then there was in London everything that went to make such an endowment; but hitherto these forces had merely been units. They had had no bond of union, boards of studies to regulate and concentrate all those varied efforts. There had been no faculty of medicine, of science, or of law, no absence of such organisation implied waste and sterility of effort. This was unjust to the eminent men who devoted themselves to the higher educational work. The work done in Paris by the Ecole des Hautes Etudes and by the College of France ought to be done in London by a university. London contained the personnel and the arsenal for such work—for the highest form of research which ought always to accompany the highest form of teaching. This movement did not arise from the outside world. It was not a scheme of some visionary educational reformer. It arose from a want felt by those who were themselves engaged in the work of tuition, and who were, as such, the best judges of their own work. It was a practical want felt by practical men who knew the practical deficiencies of the existing unpractical state of things. Those who had originated this movement had been surprised by the extraordinary amount of support which they had met on the threshold of their undertaking from a quarter where they had looked for it most. There could be no difficulty in starting a London Teaching University when every other capital in the world had such a body, and when countries with a smaller population than London had, not one, but three or four universities. They recognised what the University of London had done in another field, but the existing London University did not cover the field which this movement was intended to cover. There was not the slightest necessity for any collision between the university they wished to see and the university which existed—between examining and between teaching bodies. Following another illustrious example, he thought that the compromise between those two bodies would be easily attained. Mr. Dupont had said that the object of examinations was, that those who submitted to them might show that their knowledge was thorough. The object of this movement was not to lower the standard of examinations in any way, but to widen the avenues which would decrease the number of those who failed at examinations and increase the number of those whose labours outstripped the usual standard of examination.

It would not be difficult to demonstrate that the new University, if established upon the lines of the sub-committee's report, not only because it is not required, but because it would, by seriously imparing the freedom of our technical and professional schools, whose certificates are of infinitely greater value, commercially and otherwise, than any degree which such a Teaching University as that proposed could confer, that the chartering of it, to say nothing of its endowment, would be objectionable and mischievous. Toward the end of his speech Lord Reay became more poetical than practical, and expressed which even the most sanguine could never expect to be realised. It is gratifying to know that his lordship stated that no institution which was doing the work of University education in London would be interfered with. A federation of institutions, which would by the very fact of this federation, have increased its power for good was what was aimed at. A federal council would protect them, and see that their interests were greater than now. A centre was required in London, round which all those educational efforts could rally—a centre which would attract not only the population of London, but our colonists, our Indian subjects, and, he had also been assured, our American cousins. A reproach would be removed which at present existed, and he had no doubt that were there was a will, such as was indicated by this assembly, there would easily be found a way. There were times when a great deal was heard of disendowment and of destruction. They were there that day to endow London, to endow the higher education of the country, to endow research with an institution which they hoped would do good to future generations, and strengthen those traditions of scientific enquiry, of higher classical knowledge, of medicinal science, and of research, which was to be hoped would spread lustre over our country.

The evils of "cram" were recognised by Lord Justice Fry, as they are by everyone who has had any experience of studying and examinations, but he was evidently not greatly enamoured of the scheme. Far more to the point, however, were the remarks of Prof. Ray Lankester, who said that he thought it would be undesirable to touch London University at all, and that an independent position should be taken up. The example of Owen's College should be followed. University and King's Colleges might furnish a nucleus on which a charter might be conferred in the first instance for the granting of degrees in art and science. Then, by negociation with medical schools and corporations, these powers might be extended to medical degrees; then by and bye, after negociation with legal bodies, power might be obtained to grant degrees in law. But by attempting to bring all those bodies together at once, and so to construct an organism, they would be dealing with the elements of class in an unnatural way; and, the professor might have added, in a way that would render success and utility alike impossible. It is not improbable that the whole project would have ignominiously collapsed had it not been for the middle course between recognition and rejection, proposed by Sir George Young, who suggested that the necessity of gentlemen committing themselves to the details of the scheme might be avoided by altering the resolution so as to receive rather than to adopt the report. It was not desired to set up a new teaching institution or a new examining institution. What was desired was to afford to the scattered parts of the university about London that unity which they might attain through proposals resembling those now made. And as a university was not complete without medicine and law, and as the Colleges of Surgeons and Physicians, and the Council of Legal Education were charged with important functions in directing professional education, it was impossible there could be a worthy Teaching University for London without a close alliance with those bodies. The representation of various important bodies on the board of studies was essential. A Teaching University of London might perfectly well exist side by side and in harmony with the existing university. As to the curriculum, it was not for them to say how the University should be governed, but merely to say how they could set about the work of bringing together the scattered members of the University of London which at present existed. In admitting that this was a teachers' movement, Sir George has evidently done the project no good, for it is a tacit admission that the requirments of students is but a secondary matter.

In the result the report was merely adopted, and the further consideration of it adjourned—no doubt the wisest course that could have been adopted, for already the weak points and objectionable features of the scheme are being pointed out, so that the enthusiasm of even its promoters may have cooled down by the time of the next meeting. With reference to the matter a competent authority admits that London stands in the exceptional position of being a capital without a University which teaches, instead of confining itself to examining and conferring degrees, but asks, Does it follow, however, that its exceptional character in this respect is a disadvantage? When all is said, the chief benefit of University teaching consists in the academic life, such as, for obvious reasons, is impossible in London, and would receive a formidable blow even in its proper homes if a University such as is now proposed were to become the standard of English University training. The scheme, it is added, is obviously too immense, and too fertile in considerations of detail, to be dealt with briefly. But at any rate one grave objection will have to be removed—the danger of bringing the entire body of professional education under one fixed and inelastic system, such as we find exemplified in the case of the Ecole des Hautes Etudes in France, and by our own fixed systems of elementary and lower class education. The whole idea, as at present before the world, distinctly confuses the ideas of professional and academic training. How will a law student, for example, benefit by being under the same council with a student of medicine or painting, or *vice versa?* Professional, that is to say, practical studies are amply provided for; and it would be a distinct misfortune if students from London are discouraged from preliminary preparation in the Universities, where bread winning is still, in theory, regarded as a secondary aim. And if such a student desires to take a degree in arts at home, there are the classes of King's College and University College open to him already. So vague and costly a scheme has first of all to prove its necessity; and this unquestionably still remains to be done. The federation of our technical, scientific, and professional schools is no doubt desirable and practicable; but it must be upon an entirely different basis from that proposed by the Committee for promoting a Teaching University for London.

TIN MINING IN THE STRAITS SETTLEMENTS.—By the last Tasmanian mail we have received important advices respecting the development of this industry. The Tasmanian News states that a syndicate has been formed recently in Hobart to prospect for tin in the Straits settlements, Mr. Geo. Browne having received a concession of 1000 acres of tin-bearing land from the Rajah of Perak, and on his return to Tasmania a syndicate of 14 residents in Hobart was formed to work 500 acres of the land. Mr. L. E. Johnson was sent to prospect the property. He commenced to work at Kamunting, and on Aug. 21 wrote that 13 bores had been put down 30 ft., finding a magnificent wash, ranging from 5 ft. to 11 ft. in depth. On Oct. 8, Messrs. Sandiland, Butter, and Company telegraphed to the local manager of the syndicate that they had inspected the claim and found the prospects grand, there being 30 ft. of rich wash. It is the intention of the syndicate to float the property on the London market. Of the remaining 500 acres ceded to Mr. Browne, 250 acres have been placed in the hands of Sir Henry Lefroy and 250 acres in the hands of Mr. Weld-Blundell, to be disposed of similarly, Mr. Browne still retaining an interest in another 1000 acres which have been ceded to Mr. Browne and a syndicate at Selangor, embracing most of those in Perak. A venture has been formed to prospect it, and the services of Mr. George Lightly, lately the mining manager of the West Cumberland, Mount Heemskirk, have been secured as prospector. This gentleman, who is well known in Cornwall, left Hobart for the new field on Oct. 30. The mode of working in the existing mines at Perak is described by Mr. Johnson as being of the most primitive kind, but the claims are of the most remunerative character in the world; and, with modern appliances, the Hobart Company should reap a rich reward for their enterprise. There is quite a rush from the Australian colonies to the Straits settlements just now, and the reports of the finds of tin there are so extraordinary that, if they are only fractionally true, the result must of necessity cripple lode mining in a very great degree.

EXPLOSION AT WORSBOROUGH DALE GUNPOWDER FACTORY.—The report of the Government Inspector, Col. A. Ford, on the explosion at the factory on Oct. 15, which resulted in the loss of one life, has just been printed. The accident occurred in the mill house, where in the process of manufacture the powder had to pass under rollers similar to those used in making mortar. Part of the duty of the millmen was to sweep up the powder in the trough as it revolved, and in this they had to exercise great care, for it was found that if too much powder was removed and the rollers allowed to revolve on the bare bed of the trough the friction set up was very likely to cause an explosion. The Inspector was of opinion that the explosion occurred in this way. From a metal paddle found on the left hand side of the millmen, it would appear probable that before proceeding to brush up he used the paddle in order to give the charge a preliminary loosening. With regard to the blame in the matter, the owners of the factory assumed a heavy responsibility when after the warning conveyed by the Inspector in a letter dated Dec. 27, 1883, they did not remove all metal implements from their building, and forbid their further use. When an accident brings to light any defective method of working or dangerous appliance the use of such method or appliance ought not to be continued when the defect or danger is pointed out by a Government Inspector, nor should his recommendation be lightly treated as a suggestion to be disregarded or not as the manufacturer may think fit.

VALUING SPECIMENS.—In his article on valuing a specimen, given in his book on Assaying, published in London by Messrs. Trübner and Co., of Ludgate Hill, Mr. C. H. AARON has, he writes, omitted to inform the reader that, for the purpose of determining the value of a specimen by weighing it, and each of the component substances in air and in water, it is not necessary that the water be pure, nor at standard temperature, &c., as it would be were the *true* specific gravity required. In this case the quantities required are only relative, and *any* water will answer the purpose. When a very close approximation to true specific gravity is required, and the water at command is not pure, heat it until 1 c. c. weighs 1 gramme; it will then serve the purpose, though for rigid exactitude the barometric pressure must be considered. In the San Francisco Mining and Scientific Press, of October, 1881, he gave nine different rules for finding the value of a specimen. He selected what seemed to him to be the easiest for the book; but he finds that some prefer the second rule for those cases in which the specific gravities of the metal and the gangue are assumed, as is usual with gold in quartz. This rule is:—From specific gravity of specimen, multiplied by specific gravity of gold, subtract specific gravity of specimen, multiplied by specific gravity of quartz for a division, and from the same subtract specific gravity of quartz, multiply by specific gravity of gold, for a dividend. Divide, and multiply the quotient by weight of specimen; the product is the weight of the gold. Taking the same example as given in the book:—

$8 \times 27 = 136$	136
$8 \times 2{\cdot}6 = 20{\cdot}8$	$17 \times 2{\cdot}6 = 44{\cdot}2$
Division, 115·2	Dividend, 91·8

The quotient = 0·797, multiplied by 32, gives 2·55 ozs. of gold.

GAS LIGHTING TECHNOLOGY—No. I.

The annual meeting of the American Gas Light Association at Washington appears, from the detailed report of the proceedings published in the American Gas Light Journal, to have been an unusually interesting one, whilst the discussions which took place upon the memoirs submitted were particularly animated. Among the papers read were several which will be of equal interest on both sides of the Atlantic. Mr. C. E. HEQUEMBOURG, of Bradford, Pennsylvania, read a paper on NATURAL GAS, in which he stated that that fluid had attracted attention as an agent for illumination as long ago as 1821, when a gas spring or well was discovered at Fredonia, New York, within a rod of the old State road that passes through the village. The spring, as then, is now located in the slate rock that forms the bank of the Canadaway Creek. Gas was collected by excavating and covering the spring, conveyed into a small copper holder, and from thence conducted through pipe to a mill and several stores for illumination. To Mr. Elias Forbes, of Fredonia, Mr. Hequembourg has been for many years indebted concerning information given regarding this gas, and he now vouches for the accuracy of the statement obtained from a history of Chautauqua County:—

The use of natural gas at Fredonia was begun in 1821, when experiments were made to determine its illuminating value, and it was introduced into a few of the public places, among which was the hotel that then occupied the site of the Taylor House, and which was then illuminated when Lafayette passed through the village in 1824. The gas so used at that time was the first used in the United States, and the gasworks established here were the first in this country. The spring first discovered and from which gas was first used is located on the north bank of the Canadaway Creek, at the bridge crossing the stream on Main-street, in the village of Fredonia. The gas escaped in various places in the immediate vicinity, but when the well was sunk it was all drawn to it. The gas from this well, which was sufficient for 30 burners, was used alone till 1858, when another was sunk on the creek in the north-west part of the village by Preston Barmore, the shaft being 30 ft. deep, 6 ft. in diameter at the top, and 14 ft. at the bottom, with two vertical borings—one of 100 and the other of 150 ft. in depth. In the fall of 1858 Elias Forbes, the present President of the Gas Company, purchased a half interest in the well, and that fall a company was formed, and during the remainder of that and the following year the gas, in sufficient quantity to supply about 2000 cubic feet per day, was conducted to the village through 3 miles of mains, and supplied directly from the well to the stores of the village. During the latter year (1859) the company put in a gas receiver or holder of 12,000 cubic feet capacity, and supplied private houses. In the fall of 1871 Alvah Colburn made a boring for gas near his mill, with a view to supplying fuel for generating steam therefor; but the supply was inadequate for that purpose, though it was evolved in considerable quantity. He, therefore, purchased the Barmore interest in the gas company, and connected his well, which is 1200 ft. deep, with the company's receiver; since which time the supply of gas has been ample for the demands of the village. Previous to the opening of Colburn's well the supply of gas was not sufficient to meet the demands for it during the winter, and the deficiency was made up by gas manufactured from coal. Prof. Hoadley's experiments show that the consumption of natural gas as compared with that manufactured from coal, through burners of equal capacity and in equal times, is less than one-half, with a greater candle power. He shows that a burner which consumed 6 ft. of coal gas in one hour, with an illuminating power equal to 14 sperm candles, six to 1 lb., consumed of the natural gas a fraction less than 3 ft, with an illuminating power of a little more than 16 sperm candles. The natural gas also possesses a greater diffusive power, and one who has been accustomed to the use of coal gas, finding it difficult to read ordinary print without being in close proximity to the light, is astonished at the facility with which he can read in any part of an ordinary-sized dwelling room under the light from the natural gas.

For an analysis of this gas and that of other gases, especially that obtained from the Wilcox Well, in Sergeant Township, McKean County, Pa., from which and others near by the City of Bradford obtains its present supply, Mr. Hequembourg copies from the paper of Prof. Samuel P. Sadtler, read before the American Philosophical Society, March 2, 1877:—The hydrocarbons of the marsh gas series in three analyses can be counted together with perfect accuracy as 98·59, 89·73, and 91·55 per cent. respectively, or we have a choice of two methods of reckoning the individual amounts with proximate accuracy, however, only. In these analyses the second method of estimation—that of dividing the amount between marsh gas and propyl-hydride appears the more probable. A casual examination of these figures, with a reference to the approximate geological horizon in each case, will show several well-marked peculiarities. . . . The gas from the McKean County geological horizon, obtained at the Wilcox Well, is distinctly different from any of those preceding it. The 29·29 per cent. ethyl-hydride makes it a heavier gas. The three gases from the Lake Erie border, however, show the greatest differences. The per cent. of the ethyl-hydride exceeds the per cent. of marsh gas, so that it becomes reasonable to estimate some of these heavy hydrocarbons as propyl-hydride. These three gases would be the heaviest of all those examined. An experimental determination of the specific gravity of the Erie gas, made by the diffusive method, gave 804; the specific gravity as calculated from the analysis was 845. After gas was found at Fredonia such discoveries from year to year became more common. Judge Campbell, of Westfield, N.Y., by contract with the U.S. Government lit (until abandoned about the year 1856) the lighthouse at Barcelona, a small harbour on Lake Erie, from a spring of natural gas.

In 1827 a contract was made by Walter Smith, of Dunkirk, N.Y., with the Government to light the lighthouse at that place for a term of years, and a ½-in. lead pipe was laid 2½ miles from the Matteson gas spring at Fredonia, but owing to the size of the pipe no flow was obtained, and after many trials of other means of transportation the enterprise was abandoned. With the discovery of oil at Titusville, Pa., in 1858-9, the many borings yielded more or less gas, and the first public notice taken of it in quantity was the burning of the Rouse Well, in Oil Creek, where a large number of persons lost their lives by the explosion of gas, it having been fired from a lighted cigar. As strange as it may seem this gas was then considered more of a nuisance than an article of value, and but little was used as fuel—it was mostly led from the wells in pipes and burned, so as to dispose of it. Anyone who passed through Petroleum Centre in 1869, when the oil development of McCray Hill was in its prime, cannot fail to remember this great waste of valuable fuel.

With the improved methods of dry drilling gas has been more easily found and controlled, and although natural gas in late years has been found outside of the oil regions, where there was even no indication of oil, such facts only tend to strengthen some of the theories advanced regarding its origin. The most reasonable is that gas is found in the sand rock or oil sand only, as is salt water, and that its presence there is owing to fracture of the rock below. All gas wells of great volume are supposed to be fissure wells, the gas being generated in the carbonaceous shale hundreds of feet below any of the oil-producing sands. That this is reasonable may be concluded from the fact that the largest wells do not at all times fill up the adjoining sand rock, but only the faults or extreme edges; and it is a known fact that in sand rock where there is the most oil the gas is lightest, and where there is little oil the gas is strongest. As an illustration of the volume or pressure of gas the wells used for the supply of the City of Bradford, located in Sergeant Township, Pa., are showing a pressure (confined) of 550 lbs. to the square inch; while that shown at ordinary oil wells, under like conditions, varies from the atmosphere to 60 lbs. The pressure at all times does not indicate the producing power of a well; but, as before suggested, the location of a well near to a fissure should make it lasting and profitable, or if too far remote unsatisfactory and of small value. A complete and valuable record and history of several of the wells now controlled and used in supplying the City of Bradford is given in the report of the Second Geological Survey of Pennsylvania, by Chas. A. Ashburner, published in 1880. The first of these wells were drilled in 1864, and there is no section of territory yet developed that has produced a like quantity of gas.

For fuel in the manufacture of steel, iron, and glass the past two years' experience in the City of Pittsburgh, Pa., indicates that natural gas can take the place of other fuel to the advantage of the manufacturer; and, therefore, an elaborate comparison of cost between this gas and coal is not necessary, and would be made at great disadvantage, as there is no city in this country where coal is so cheap as at Pittsburgh. Were it not for the fact that gas fuel is so easy to control, clean, pure, and capable of raising the most intense heats, and that such considerations increase its value by the saving of labour and saving of the materials manufactured, it could not be used for these purposes, as will be shown hereafter by some limited tests as to its caloric power expressed in cubic feet, compared with 1 lb. of coal, &c. For combined purposes of heat and light the Bradford Gas Light and Heating Company supply an average daily demand of several millions cubic feet. This is done at an estimated cost to the consumer of 13 c. per 1000 cubic feet. The candle power of the gas supplied varies from 8 to 24, and the specific gravity, as shown by Prof. Sadtler, is about 804. The gas registers in meters a little less than one-half that of coal gas, burned in the same time through the same burner with equal pressure. In order to supply the great demand for this gas the company own and control 8000 acres of gas land, 29 miles of 8 in., 7 miles of 6 in., and several miles of 5⅛ in., 3 in., and 2 in. cast and wrought iron high-pressure conduits, that carry gas from fields distant from Bradford 2, 12, and 25 miles. These mains carry variable pressure of 50 to 160 lbs. to the square inch; and in order to increase the flow through these pipes during extreme weather they operate a pump station of 580-horse power to compress, and by this additional pressure and acceleration of volume increase the flow. Results of many average tests show—1. Compared with coal gas natural gas exceeds it in caloric value 33¼ per cent.—2. With crude, ordinary, and best methods for combustion the caloric value of natural gas compared with coal under best conditions is—With crude method, 20 cubic feet=1 lb. coal; with ordinary method, 11·29 cubic feet=1 lb. coal; with best method, 8·92 cubic feet=1 lb. coal.—3. The value of 1000 cubic feet of natural gas under conditions below, compared with coal at 4s. 6d. per ton:—With crude method of carbonisation, ·0250 per 1000; with ordinary method of carbonisation, ·0443 per 1000; with best method of carbonisation, ·0635 per 1000.

On the motion of Mr. H. B. LEACH the thanks of the Association were tendered to Mr. Hequembourg for his valuable, interesting, and instructive paper.

In the discussion which followed the reading of the paper, Mr. HEQUEMBOURG, in reply to a question, stated that the confined gas from the well at Bradford maintained a pressure of 550 lbs. to the square inch. The ordinary pressure of the gas from the other borings in the Bradford region (these borings having been put down principally for oil) varied from atmospheric pressure to 60 lbs. to the square inch; and usually, when confined, they seldom exceed 52½ lbs. to the square inch. The illuminating value of the natural gas used in Bradford varied under different conditions from 8 to 24 candles. The reason for this, as he understands it, is that there appears to be no method of burning natural gas satisfactorily except through the Argand burner. With an Argand burner rated to a consumption of 5 ft. per hour the photometric tests which have been made indicate 24-candle power; but under unfavourable conditions, or with burners that are not adapted to consume the gas properly, the candle power is very limited.—Mr. HELME: Does your figure of 550 lbs. represent the original pressure at the time when the veins were first tapped?—Mr. HEQUEMBOURG: No; originally the wells were opened 20 years ago, and we did not obtain control of them for purposes of supplying their product to the City of Bradford until about two years ago. During the first period of 20 years three of the wells were exposed, and no attempt had been made to control them. What the pressure was at the time they were first tapped cannot be stated; what their pressure now is can be readily told.—Mr. HELME: Have the wells maintained a uniform pressure for the two years during which your company has controlled them, or is the pressure diminishing?—Mr. HEQUEMBOURG: We do not see that it has in any way decreased.—A MEMBER: At what depth do you usually strike the gas vein?—Mr. HEQUEMBOURG: Of course the depth at which the vein is tapped varies with the locality; but it is usually pierced at about sea level through the country, which, in our vicinity, would be at a depth anywhere from 1000 to 2500 ft.—Mr. J. P. HARRISON: It would be interesting to know what storage facilities the Bradford Company maintain, and whether the company could supply a send-out reaching to several million cubic feet per day.—Mr. T. LITTLEHALES: At the times when you find the illuminating power so low have you any method of supplementing it?—Mr. HEQUEMBOURG: I do not say that the candle power does vary; I merely suggest that owing to there being no proper method of burning the gas none of the ordinary tests of illuminating value clearly indicate the candle power. In other words, a rated 5 ft. coal gas batswing or fishtail burner will consume less than 2½ ft. of this gas per hour. At the ordinary pressures in the burners mentioned you cannot burn a larger quantity than that just stated without showing a smoking or imperfect blue flame.—Mr. HELME: Do you purify the gas at all?—Mr. HEQUEMBOURG: No; we do not find purification to be necessary. You will notice that the analysis contains no mention of sulphuretted hydrogen.—Mr. MCELROY said—I have never carefully tested for illuminating value any of the natural gases excepting the Olean district product. I have, however, discovered that the Olean manufacturers place their computations on the basis that 22,000 ft. of natural gas equals the calorific power of 1 ton of coal. It is sold to the blast furnace proprietors on that basis.—Mr. HEQUEMBOURG: We have made very careful tests of the calorific power of the Bradford gas—first, by measuring the number of cubic feet per 1 lb. that it required under ordinary conditions to evaporate a certain number of pounds of water. I took a boiler 14 ft. in length, 62 in. in diameter, and having 96 3-inch flues. It was set in an ordinary arch. With this boiler I made a number of six hour tests, using gas for fuel, under all sorts of conditions, and then reversed the firing conditions by substituting coal—care being taken to make the tests identical as to time, &c. We found that as a result we could evaporate about 8·55 lbs. of water to 1 lb. of coal. On the other we proved, taking the results ensuing from the best conditions of gas firing, that 7·95 cubic feet of the gas would evaporate 1 lb. of water.

Mr. MCELROY: Mr. Young and myself also went through a series of experiments on this question. The natural gas tested came from the Butler County district. We tried all the various methods of evaporation. In our test boilers we evaporated 9·5 lbs. of water to 1 lb. of Pittsburgh coal; and the outcome of the tests went to show that the calorific effect of the ton of Pittsburgh coal equalled that resulting from a consumption of 22,000 ft. of Butler gas. An approximate result was obtained in heating an iron puddling furnace. We weighed our coal and measured our gas. We ran day and day about, alternating in the same furnace, and continued the experiments for about six weeks.—Mr. J. C. PRATT: This may be a very interesting subject, but still it is one of very little practical value to the members of the Association, except to those who live in the neighbourhood of these gas wells. We have, as I understand, several very practical papers adapted by their subjects to interest practically all the members of the Association, and I think that further controversy on this particular topic should cease so we may be afforded an opportunity of discussing the other papers to be presented.

Capt. WHITE: I beg to differ with the gentleman. I think the subject of natural gas is one of very great interest to the gas fraternity; at least it is likely to become so, as natural gas is now being bored for in many sections of the United States, and also in Canada.

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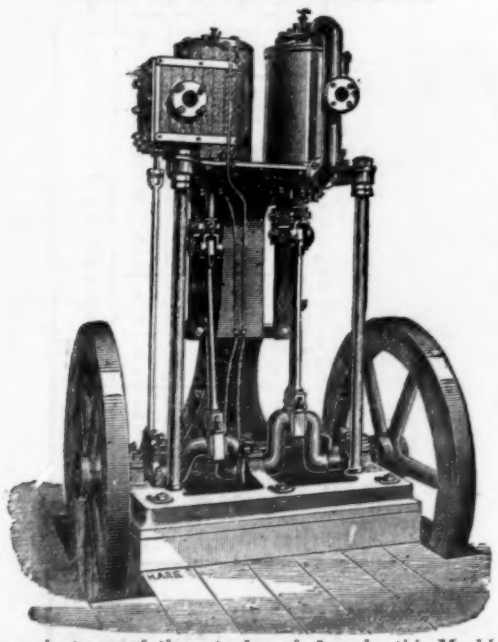

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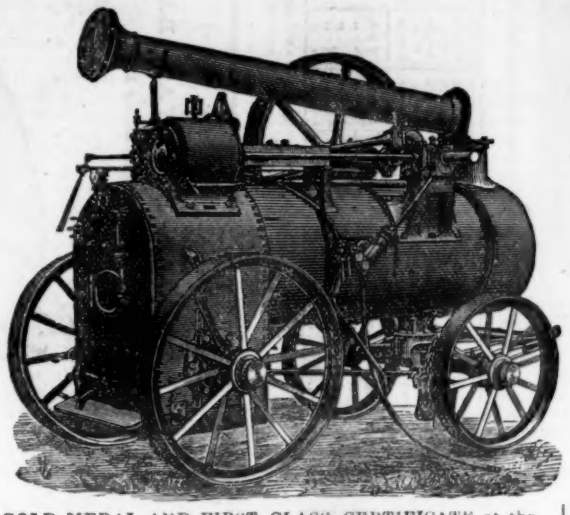

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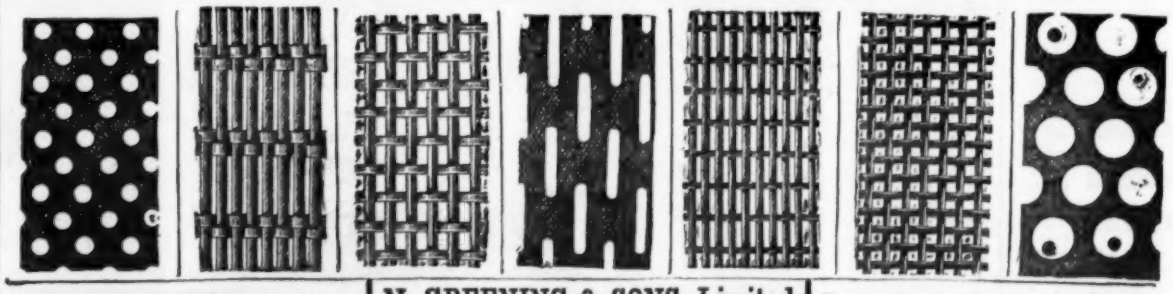

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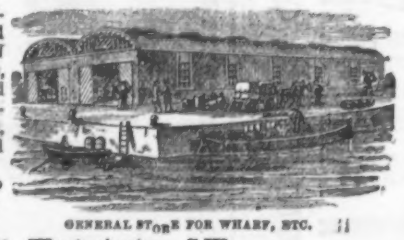

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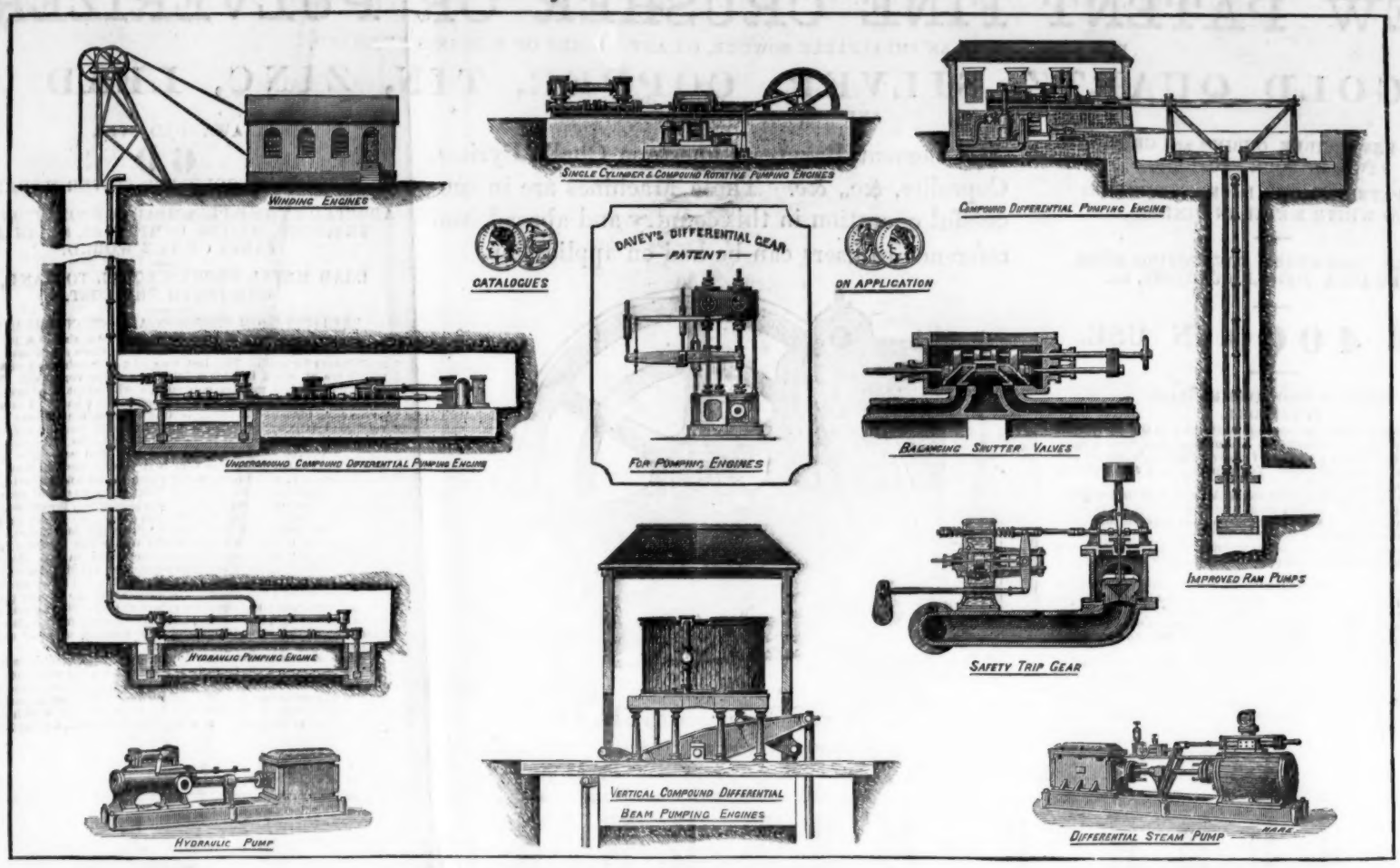

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Yours truly,
T. F. EVANS,
Late H.M. Inspector of Metalliferous Mines.

Mr. J. Bell.

Manchester, Sheffield, and Lincolnshire Railway—Steamship Department,
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G. H. CLARKE, Sup. Engineer.

Mr. J. Bell.

Department of the Director of Navy Contracts,
Admiralty, Whitehall, 20th June, 1884.

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To Mr. John Bell. JOHN COLLETT, Director of Navy Contracts.

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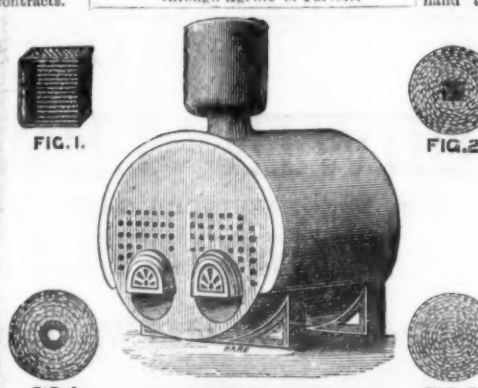

FIG. 1.

FIG. 2.

FIG. 4.

FIG. 3.

BELL'S ASBESTOS BOILER AND PIPE COVERING COMPOSITION, for coating every class of steam pipes and boilers, non-combustible and easily applied when steam is up; adheres to metals and preserves them from rust; prevents the unequal expansion and contraction of boilers exposed to weather; covers 50 per cent. more surface than any other coating, and is absolutely indestructible. It can be stripped off after many years' use, mixed up with 20 per cent. of fresh, and applied again. The composition is supplied dry, and is only to be mixed with water to the consistency required for use.

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BELL'S SPECIAL LONDON-MADE ASBESTOS MILLBOARD, for Dry Steam Joints, made of the best Asbestos fibre, is well-known for its toughness and purity, and is absolutely free from the injurious ingredients frequently used to attain an appearance of finish, regardless of the real utility of the material. Made in sheets measuring about 40 in. square, from 1-64th in. to 1 in., and ½ millimetre to 25 millimetres thick. Each sheet bears the Trade Mark.

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